

FIG. 1


FIG. 3A is a screenshot of a software interface. At the top, a box labeled 'Process Indicator' and '70' contains two items: '1) Still To Do: Prepare Boundary Diagram' and '2) Next To Do: Prepare Interface Diagram'. Below this, there are two main task sections. The first section, labeled '1 PREPARE BOUNDARY DIAGRAM' and '72', includes the instruction 'Attach file containing the Boundary Diagram prepared for this FMEA. Input comments below.' followed by a text input field with up and down arrow buttons. Below the field is a file icon and the text 'Click to attach file here'. The second section, labeled '2 PREPARE INTERFACE MATRIX DIAGRAM' and '120', follows a similar format with the instruction 'Attach file containing the Interface Matrix diagram for this FMEA. Input comments below.', a text input field with up and down arrow buttons, and a file icon with the text 'Click to attach file here'.

FIG. 3A


Item	Function	Potential Failure Mode	Potential Effect(s) of Failure	Severity	Class	Potential Cause(s)/ Mechanism(s) of Failure	Occur	Current Design Controls Prevention	Current Design Controls Detection	Detect	R.P.N.	Recommended Action(s)	Responsibility & Target Completion Date	Actions Taken	Action Results			
															Sev	Occ	Det	R.P.N.
28															36	58	60	62
30																		
32																		
34																		
36																		
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62																		

FIG.2

130 118 ☐ 3 PREPARE PARAMETER DIAGRAM
Attach a file containing the Parameter Diagram for this FMEA. Input comments below.

 Click to attach the file here

154 118 ☐ 4 GENERATE FMEA FORM
Attach file containing the FMEA Form. Input comments below.

 Click to attach file here

162 118 ☐ 5 REVISE FMEA FORM
Attach file containing the revised FMEA Form. Input comments below.


 Click to attach file here

FIG.3B

BOUNDARY DIAGRAM

Automatic Transmission Shift Quality Example

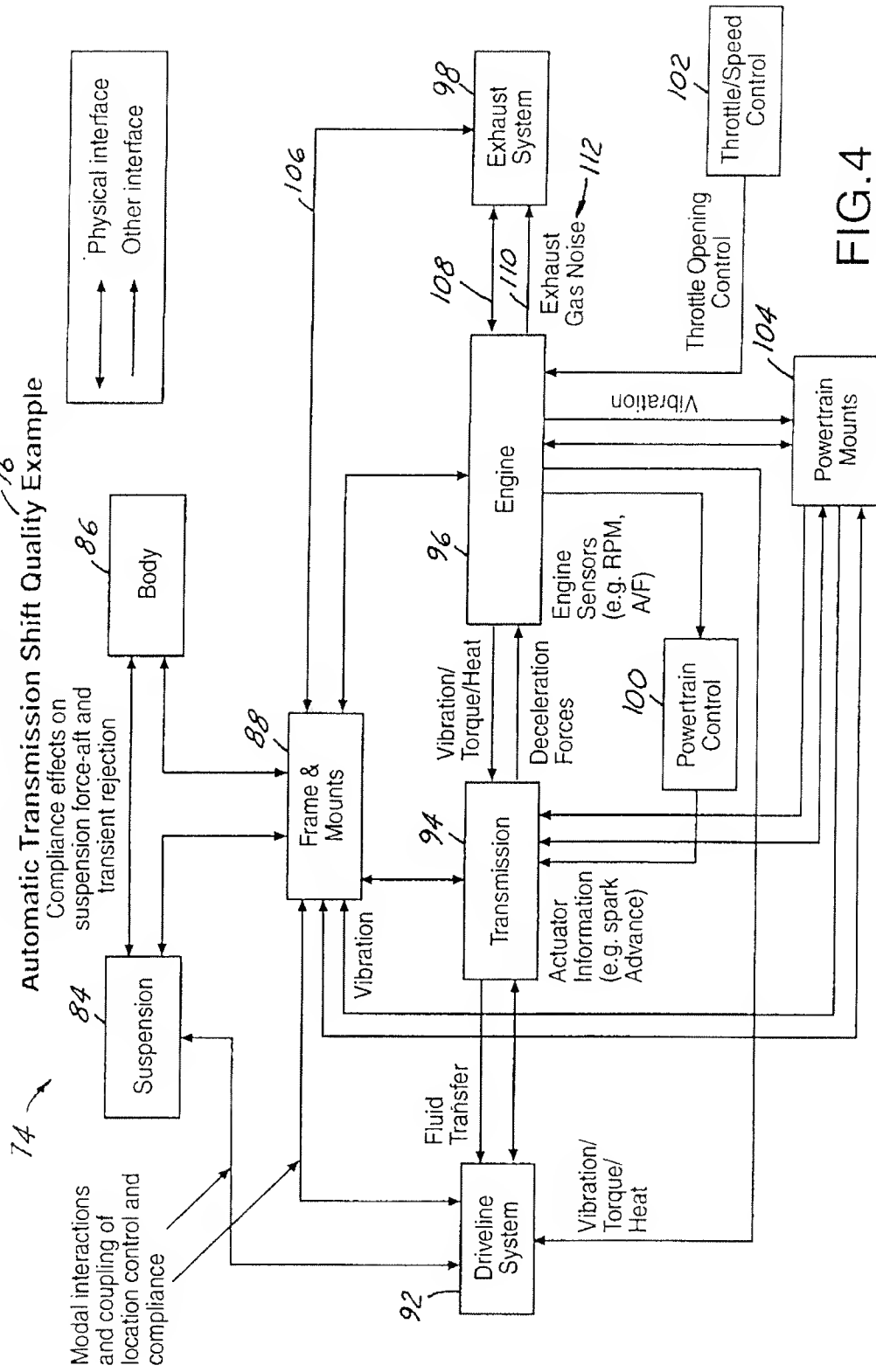


FIG.4

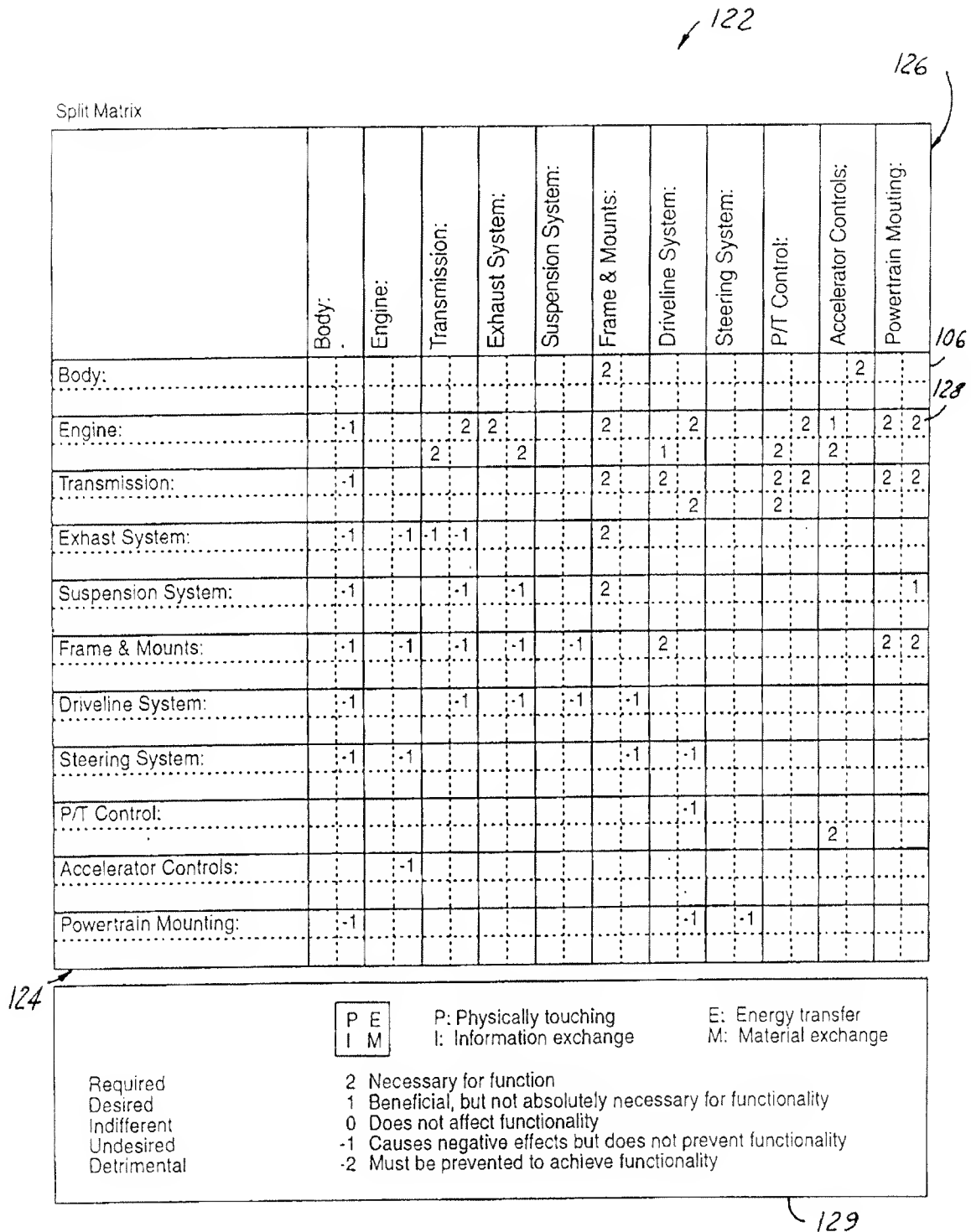
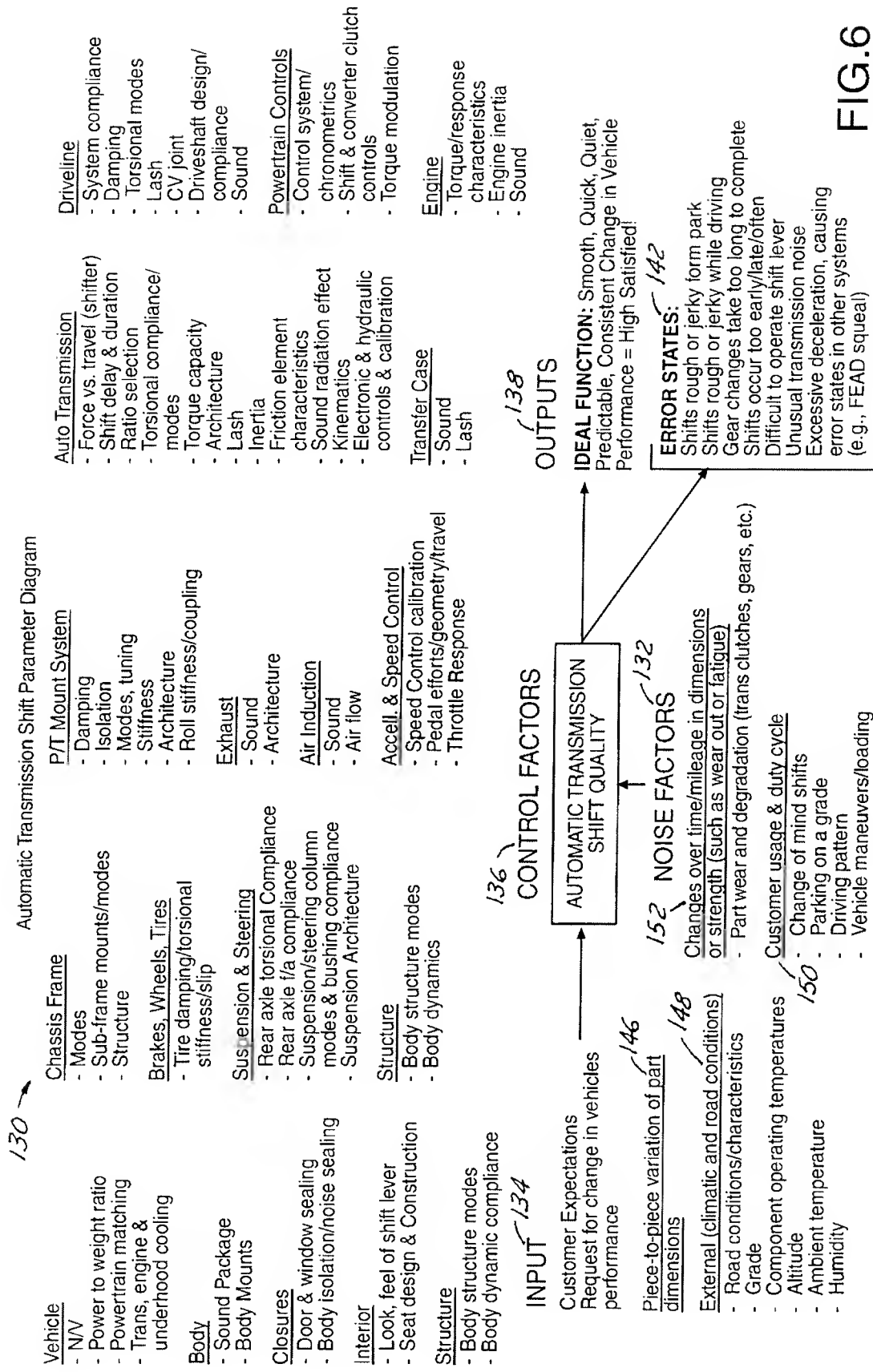


FIG.5



136 CONTROL FACTORS

138 OUTPUTS

134 INPUT

Customer Expectations
Request for change in vehicles performance

146 Piece-to-piece variation of part dimensions

148 External (climatic and road conditions)

- Road conditions/characteristics
- Grade
- Component operating temperatures
- Altitude
- Ambient temperature
- Humidity

150 Customer usage & duty cycle

- Change of mind shifts
- Parking on a grade
- Driving pattern
- Vehicle maneuvers/loading

132

AUTOMATIC TRANSMISSION SHIFT QUALITY

152 NOISE FACTORS

Changes over time/mileage in dimensions or strength (such as wear out or fatigue)

- Part wear and degradation (trans clutches, gears, etc.)

IDEAL FUNCTION: Smooth, Quick, Quiet, Predictable, Consistent Change in Vehicle Performance = High Satisfied!

ERROR STATES:

- Shifts rough or jerky form park
- Shifts rough or jerky while driving
- Gear changes take too long to complete
- Shifts occur too early/late/often
- Difficult to operate shift lever
- Unusual transmission noise
- Excessive deceleration, causing error states in other systems (e.g., FEAD squeal)

FIG.6

Item/Function	Potential Failure Mode	Potential Effect(s) of Failure	Sav	Class	Potential Cause(s)/ Mechanism(s) of Failure	Occur	Current Controls
							Prevention
<p>Function: Needs, Wants, Requirements</p> <p>Must be verb-noun measurable or constraints</p> <p>Methods: Brainstorm</p> <p>Input Include: Function tree, Previous/ similar FMEAs, SDS, Boundary Diagram, QFD</p>	<p>4 Thought Starters: No function Partial /over function/degraded over time Intermittent Function Unintended function</p> <p>Methods: Brainstorm using 4 Thought Starters List each in separate field</p> <p>Input include: P-diagram, Interface matrix, Similar FMEAs, 8D's, Warranty, TGW</p>	<p>Including: Government/safety Ultimate Customer, Vehicle, Other systems, Subsystems, Components, Item, Manufacturing/ assembly/service</p> <p>Methods: Brainstorm, Rate each; put highest in next column</p> <p>Inputs include: P-diagram, Interface Matrix, Warranty, 8Ds, TGW Previous similar FMEAs</p> <p>For classification: See FAP03-111 or Section 6 of this Handbook. As of this date = YC or YS or blank.</p>			<p>For cause: Why has this happened or how might this happen?</p> <p>Use 2 assumptions: 1) Item will be manufactured/ assembled to specification 2) Design includes a deficiency that may cause unacceptable variation</p> <p>Methods: 1) Brainstorm 2) Rate each occurrence-put in next column</p> <p>Inputs include: Warranty, 8D, TGW, Previous/similar FMEAs, P-diagram, Interface matrix, test data</p>		<p>Controls are already planned, or are normal and customary for this type item</p> <p>Remember that Prevention Controls have and affect on the Occurrence</p> <p>Inputs include: Warranty, 8D, TGW, Previous/ similar FMEAs, Test data, Previous DV plan, P-diagram</p>
<p>Catalytic Converter must suppress the generation of Sulfur odor (H₂S) that can be detected by the customer (rotten egg smell) (ppm/test H₂S) for target life of vehicle. (10yr/150K MI) (PZEV, 15yr/ 150K MI)</p>	<p>Excessive release of H₂S</p>	<p>Customer dissatisfaction (Unpleasant Odor) (Rotten Egg Smell)</p>	7	YS	<p>Improper Calibration:</p> <ol style="list-style-type: none"> 1) Rich A/F excursions - during transients - at idle - Canister purge at idle and during low speed cruises 2) Lean A/F excursions - during transients - during decels with coordinated with fore-aft oxygen control 3) Catalyst Temperature Model false triggering of enrichment 4) Closed loop fuel control - peak-to-peak amplitude (>0.03 lambda) 5) Tailpipe O₂ - minor amount (<0.03%) not present to ensure that SO₂ can be liberated from NiO added to catalyst (during cruises and decels) 	5	<ol style="list-style-type: none"> 1. Review Calibration Guides for H₂S prevention. 2. Review related G8D: #24094 U152 Sulfur Odor. 3. Search Technical Service Bulletin (TSB) database for H₂S, Sulfur, Smell, Rotten Egg Smell. 4. Campaign Prevention Reviews. 5. Calibration Technical Reviews.

FIG.7A

Current Design Controls Detection	Detec	R.P.N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
					Actions Taken	Sev	Occ	Det	R.P.N.
<p>Current Controls are 2 types: 1) Prevent a cause/mechanism of failure 2) Detect the failure mode or detect the cause/mechanism of failure</p> <p>Methods: 1) Rate each detective control 2) Put best (lowest) or composite in the Detection column. 10 if no detection.</p>			<p>List the action. If no action planned, enter "None" or "None at this time".</p> <p>Must have a recommended action for any special Characteristic item.</p>	<p>Enter who (not just the department), will complete and when. 11/5/2003</p>	<p>Enter a breif description of the action after it has been completed.</p> <p>Enter the revised Severity, Occurrence, and detection number to the right to reflect the results of the action.</p> <p>Recalculate</p>				
			<p>It is possible to have multiple actions against a cause or failure mode.</p>	<p>There should be a name here, XYZ department. 5/10/2003</p>					
<p>VEHICLE ARL Emissions Attribute requirement 02-0260 for Calibration 10-pager (23-0002) H2S Emissions test (6) Associated DVM: DVM 0030-23 DVM 0031-23 DVM 0037-23 DVM 0007-23 DVM 0001-23 DVM 0011-23 DVM 0017-23 Vehicle tests: Objective H2S Test Ns31 Subjective H2S Test CETP 00.00-R-221</p>	6	210	<p>1) Reduce APTL Mass Spec testing variability. 2) Develop ppm/test acceptance criteria that correlated to customer field concerns.</p>	<p>J. Sloss, M. Dennis, J. Scaparo, M. Lieborwitz 1 May 2003</p>	<p>Release updated APTL Standard H2S Test For Sign-Off (NS33) CETP 00.00-L-931</p> <p>Deleted subjective test CETP 00.00-R221</p>	7	3	2	42
			<p>(Update, released & published Corporate Quality Documents (DFMEA, Calibration Guides, CETP)</p>	<p>1) Reduce APTL Mass Spec testing variability 2) Develop ppm/test acceptance criteria that correlated to customer field concerns.</p>	<p>Released and published Corporate Quality Documents to EKB.</p>				

FIG.7B

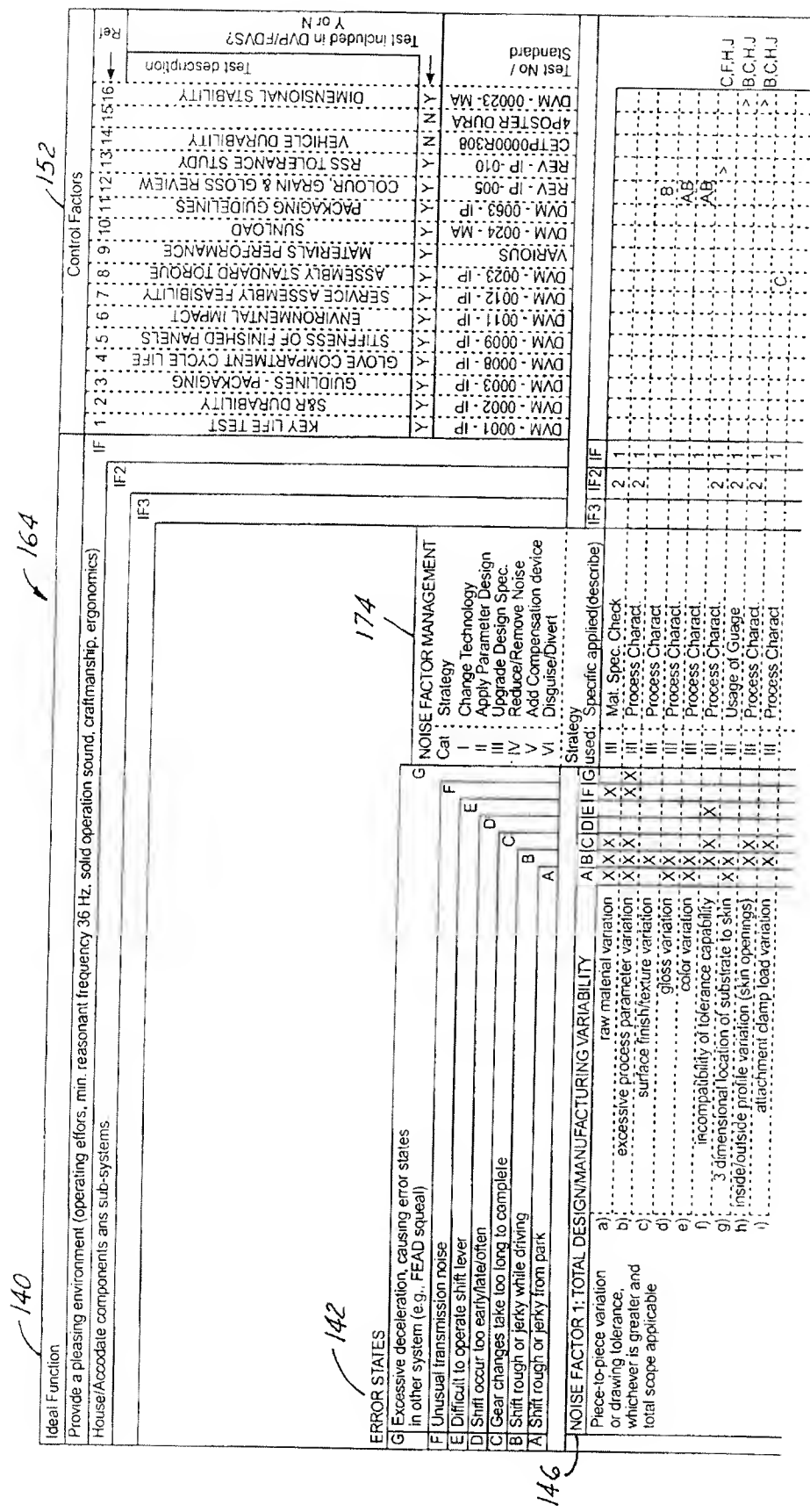


FIG.8A

NOISE FACTOR 2: COMPONENT CHANGES OVER TIMMILEAGE - Over Useful Life Period											
Change in dimension or change in strength over Useful Life Period (assumptions above)	a)	glovebox hinge dimensions (wear)	X	X	X	X	III	Process Charact.	1	C	F
	b)	wear between mating parts	X	X	X	X	III	Process Charact.	2	C	C
	c)	change in rigidity characteristics of OCB	X	X	X	X	III	Mat. Spec. Check	2	C	F
	d)	part shrinkage/distortion	X	X	X	X	III	Mat. Spec. Check	2	C	F
	e)	embrittlement of plastic components	X	X	X	X	III	Process Charact.	2	C	D
	f)	torque loss at fixings over time	X	X	X	X	III	Mat. Spec. Check	1	C	C
	g)	glovebox bump stops hardened	X	X	X	X	III	Mat. Spec. Check	2	C	C
	h)	PVC leaching (plasticizer)	X	X	X	X	III	Process Charact.	2	C	E
	i)	plastic creep under load	X	X	X	X	III	Process Charact.	1	C	C
	j)	plastic creep under load	X	X	X	X	III	Process Charact.	1	C	C
"Break-in" and/or in-use hysteresis											
NOISE FACTOR 3: DUTY CYCLE / CUSTOMER USAGE - Over Useful Life Period											
"Typical" Customer Usage over Useful Life Period (assumptions above)	a)	disassembly for service	X	X	X	X	V	Service Manual	1	C	C
	b)	road conditions	X	X	X	X	V	TBE	2	C	C
	c)	component servicing	X	X	X	X	V	Service Manual	2	C	C
	d)	spillage of liquids & food stuffs	X	X	X	X	TBE		1	C	A
	e)	IP Scratching	X	X	X	X	TBE		1	C	D
	f)	overloading glovebox	X	X	X	X	TBE		1	C	C
	g)	leaning on IP	X	X	X	X	TBE		1	C	C
	h)	feet on instrument panel	X	X	X	X	TBE		1	C	C
	i)	feet on instrument panel	X	X	X	X	TBE		1	C	C
	j)	feet on instrument panel	X	X	X	X	TBE		1	C	C

FIG.8B